



Review

On-line monitoring of volatile organic compounds at pptv levels by means of Proton-Transfer-Reaction Mass Spectrometry (PTR-MS) Medical applications, food control and environmental research

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Abstract

A proton transfer reaction mass spectrometer (PTR-MS) system has been developed which allows for on-line measurements of trace components with concentrations as low as a few pptv. The method is based on reactions of H_3O^+ ions, which perform non-dissociative proton transfer to most of the common volatile organic compounds (VOCs) but do not react with any of the components present in clean air. Medical applications by means of breath analysis allow for monitoring of metabolic processes in the human body, and examples of food research are discussed on the basis of VOC emissions from fruit, coffee and meat. Environmental applications include investigations of VOC emissions from decaying biomatter which have been found to be an important source for tropospheric acetone, methanol and ethanol. On-line monitoring of the diurnal variations of VOCs in the troposphere yield data demonstrating the present sensitivity of PTR-MS to be in the range of a few pptv. Finally, PTR-MS has proven to be an ideal tool to measure Henry's law constants and their dependencies on temperature as well as on the salt content of water. © 1998 Elsevier Science B.V.

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1. Introduction

In recent decades, trace gas analysis has been performed by means of gas chromatographic methods, which have been improved to such an extent that complex mixtures of gas components having volume mixing ratios as low as a part per trillion (pptv) and less can be quantitatively analysed with high precision. A most impressive automated gas chromatographic system has recently been developed at NOAA, Boulder by

Goldan, Kuster and Fehsenfeld [1,2]. It takes ambient air samples each hour (this time interval can even be shortened to about 30 min) on a 24-hour basis and has detection limits of 3 pptv for propane and even 0.3 pptv for aromatic hydrocarbons. While these methods represent ideal tools when static or only slowly changing mixtures are to be analyzed and monitored, on-line monitoring of mixtures with relatively fast changing concentrations (on a time scale of 15 min and less) has remained problematic.